The invention claimed is:

1. A valve lash adjustment apparatus comprising:

a valve lash lock nut-driving system movable in a valve lash lock nut tightening direction and an opposite valve lash lock nut loosening direction;

a valve lash adjusting screw-driving system operable in a valve lash adjusting screw advancing direction and a valve lash adjusting screw retracting direction;

at least one sensor operable to sense a value indicative of valve opening movement; and

a controller connected to the valve lash lock nut-driving system, the valve lash adjusting screw-driving system and the sensor;

the controller being operable to automatically move the valve lash lock nut-driving system and the valve lash adjusting screw-driving system until a desired valve lash gap is set without requiring the systems to set a valve lash adjusting screw to an initialized and true zero valve lash position.

2. The apparatus of Claim 1 further comprising an internal combustion engine comprising:

a rotatable rocker arm;

a threaded valve lash adjusting screw coupled to the rocker arm; and

a valve lash lock nut coupled to the valve lash adjusting screw, longitudinal positioning of the valve lash lock nut relative to the valve lash adjusting screw operably setting a valve lash gap of the rocker arm.

3. The apparatus of Claim 2 wherein:

firstly, the valve lash lock nut-driving system automatically rotates in the valve lash lock nut tightening direction to engage the valve lash lock nut;

the valve lash lock nut-driving system thereafter continues rotating the valve lash lock nut in the valve lash lock nut tightening direction; and

secondly, the valve lash adjusting screw-driving system is automatically rotated in the valve lash adjusting screw advancing direction.

4. The apparatus of Claim 3 wherein:

thirdly, the valve lash adjusting screw-driving system substantially prevents the valve lash adjusting screw from rotating while the valve lash lock nut-driving system is rotated in loosening direction to back off the valve lash lock nut from the valve lash adjusting screw; and

fourthly, the valve lash adjusting screw-driving system is subsequently rotated in the valve lash adjusting screw advancing direction while the controller monitors the applied torque and angle of rotation and causes the valve lash adjusting screw to be moved a desired distance displacement, as measured by the sensor.

5. The apparatus of Claim 4 wherein:

fifthly, the valve lash adjusting screw-driving system thereafter substantially prevents the valve lash adjusting screw from rotating while the valve lash lock nut-driving system rotates in a tightening direction;

sixthly, the valve lash adjusting screw-driving system subsequently rotates the valve lash adjusting screw in the retracting direction to substantially eliminate rotary coupling gap between the driving system and the valve lash adjusting screw; and

the controller monitors the torque of the valve lash adjusting screw-driving system as it rotates in its retracting direction in order to determine when the rotary coupling gap has been eliminated.

6. The apparatus of Claim 4 wherein:

fifthly, the valve lash adjusting screw-driving system thereafter substantially prevents the valve lash adjusting screw from rotating while the valve nut-driving system rotates in the loosening direction to further back off the nut from the valve lash adjusting screw;

sixthly, the valve lash is subsequently set by the valve lash adjusting screw-driving system rotating the valve lash adjusting screw in the retracting direction a desired amount determined by the controller based upon an input signal corresponding to at least one of: (a) the amount of valve lash adjusting screw-driving system rotation; (b) the sensor which is monitored to verify that the appropriate lash has been set by the angle rotation after the knee in a curve generated by applied torque and angle of rotation; and (c) by monitored displacement and angle of rotation; has been detected; and

the valve lash adjusting screw-driving system thereafter substantially prevents the valve lash adjusting screw from rotating while the valve lash lock nut-driving system rotates the valve lash lock nut on the valve lash adjusting screw in the tightening direction.

7. The apparatus of Claim 3 wherein:

thirdly, the valve lash adjusting screw-driving system substantially prevents the valve lash adjusting screw from rotating while the valve nut-driving system is rotated in the lock nut loosening direction to back off the lock nut from the valve lash adjusting screw; and

fourthly, the valve lash adjusting screw-driving system is subsequently rotated in the valve lash adjusting screw advancing direction while the controller monitors the applied torque and angle, and causes the valve lash adjusting screw to be moved a desired amount by an angle of rotation from a torque threshold valve, as measured by a torque sensor associated with the valve lash adjusting screw-driving system.

8. The apparatus of Claim 1 wherein the controller automatically inspects the valve lash setting to determine if a desired valve lash value has been obtained through prior automatic adjustment.

9. The apparatus of Claim 8 wherein the controller automatically causes selective rotation of the valve lash lock nut-driving system and the valve lash adjusting screw-driving system in order to readjust the valve lash setting if the controller determines that the lash verification measurement is undesirable.

10. The apparatus of Claim 9 wherein the controller automatically sends an error signal and stops setting the valve lash if multiple valve lash adjustments and verification determinations are performed, and the valve lash adjustment continues to be unacceptable.

11. The apparatus of Claim 1 wherein the controller causes selective actuation of the valve lash lock nut-driving system and valve lash adjusting screw-driving system in order to set the desired valve lash gap based on a point of change in a resultant value which is indicative of torque versus rotational angle of at least one of the systems.

12. The apparatus of Claim 11 wherein the controller uses the point of change in the torque versus angle determination as an initialization starting point for further setting a valve lash adjusting screw to a valve operating mechanism preloaded position which is used as a starting point to then back off the valve lash adjusting screw to set valve lash.

13. A machine comprising:

a valve lash fastener-driver;

a valve lash adjusting member-driver;

a valve lash measurer; and

a controller connected to and operably controlling movement of the fastener-driver, member-driver and valve lash measurer;

the controller operably adjusting valve lash by selectively energizing and deenergizing the fastener-driver and member-driver; and

the controller operably verifying the actually adjusted valve lash in an automatic manner based at least in part on the valve lash measurer output signal.

14. The machine of Claim 13 wherein the controller automatically verifies the valve lash setting to determine if a desired valve lash value has been obtained through prior automatic adjustment.

15. The machine of Claim 14 wherein the controller automatically causes selective rotation of the fastener-driver and the member-driver in order to readjust the valve lash setting if the controller determines that the verification calculation is undesirable.

16. The machine of Claim 15 wherein the controller automatically sends an error signal and stops setting the valve lash if multiple valve lash settings and verification determinations are performed and the valve lash adjustment continues to be unacceptable.

17. The machine of Claim 13 wherein the controller causes selective actuation of the fastener-driver and member-driver in order to set the desired valve gap based on a point of change in at least the sensed value which is indicative of torque versus rotational angle of at least one of the systems.

18. The machine of Claim 17 wherein the controller uses the point of inflection in the torque versus angle determination as an initialization starting point for further setting a valve lash adjusting screw to a valve actuating mechanism preloaded position which is used as a starting point to then back off the valve lash adjusting screw to a valve lash setting.

19. The machine of Claim 13 further comprising:

a probe operably contacting at least one of: a valve assembly component and a rocker arm;

an automatically actuated plunger operably moving the rocker arm in a direction toward a valve stem; and

a valve lash measurer operably sensing distance displacement of the rocker arm through the probe.

20. The machine of Claim 19 wherein:

the member-driver is a valve lash adjusting screw-driver which further comprises a first electric motor, a rotatable inner spindle and a valve lash adjusting screw bit; and

the fastener-driver is a valve lash lock nut-driver which further comprises a second electric motor, a gear set, a rotatable outer spindle and a nut-receiving socket concentric with the bit;

in at least one operating condition, the probe and the plunger are automatically movable toward an engine cylinder head concurrently with and within 45° of the same advancing direction as the valve lash adjusting screw-driver and the valve lash lock nut-driver.

21. The machine of Claim 13 wherein the valve lash measurer ascertains valve lash gap displacement.

22. A valve lash setting machine comprising:

a valve lash adjusting screw-rotator;

a valve lash monitor; and

an electronic control unit operably communicating with the valve lash adjusting screw-rotator and the valve lash monitor;

the control unit operably adjusting valve lash at least in part through energization of the valve lash adjusting screw-rotator;

the control unit operably using a point of noteworthy change in a set of actual sensed values;

the control unit thereafter operably causing the valve lash adjusting screw-rotator to rotate an additional predetermined amount to a valve actuating mechanism preloaded position; and

the control unit subsequently operably causing the valve lash adjusting screw-rotator to set the desired valve lash.

23. The machine of Claim 22 wherein the controller automatically verifies the valve lash setting to determine if a desired valve lash value has been obtained through prior automatic adjustment.

24. The machine of Claim 22 further comprising a probe adapted to operably contact a rocker arm and an automatically actuated plunger adapted to operably move the rocker arm in a direction toward a valve stem, the valve lash monitor operably sensing displacement distance of the rocker arm through the probe.

25. The machine of Claim 22 further comprising a valve lash lock nut-rotator including a first automatic motor and a valve lash lock nut-engaging socket, wherein the valve lash adjusting screw-rotator includes a second automatic motor and a valve lash adjusting screw-engaging bit.

26. The machine of Claim 22 wherein the set of actual sensed values is based on sensed displacement values versus valve lash adjusting screw angle of rotational values.

27. The machine of Claim 22 wherein the set of actual sensed values is based on sensed torque values versus valve lash adjusting screw angle of rotational values.

28. The machine of Claim 22 wherein the control unit operably uses a point of sudden change in the set of actual sensed values as the point of noteworthy change, calculated at least in part with input from the valve lash monitor, as an initialization starting point.

29. A valve lash adjustment apparatus comprising:

a tool comprising a first automatic rotator and a second automatic rotator selectively energizable to set valve lash; and

a verifier operable to verify the actual valve lash;

the verifier automatically causing selective energization of at least one of the rotators if it is determined that the verification reading is undesirable.

30. The apparatus of Claim 29 wherein the verifier comprises an electrical controller connected to the rotators.

31. The apparatus of Claim 30 wherein the controller automatically sends an error signal and stops the setting of valve lash if multiple valve lash settings and verification determinations are performed and the valve lash adjustment continues to be unacceptable.

32. The apparatus of Claim 30 wherein the controller causes selective actuation of the first and second rotators in order to set the desired valve gap based on a point of sudden change in at least the sensed value readings which is indicative of torque versus rotational angle of at least one of the rotators.

33. The apparatus of Claim 29 wherein a point of inflection in a torque versus angle determination is used as an initialization starting point for further setting a valve lash adjusting screw to a valve actuating mechanism preloaded position which is used as a starting point to then back off the valve lash adjusting screw to a valve lash setting.

34. The apparatus of Claim 29 wherein the verifier comprises a probe operably contacting a rocker arm and an automatically actuated plunger operably moving the rocker arm in a direction toward a valve stem and a valve lash measurer operably sensing distance displacement of the rocker arm through the probe.

35. The apparatus of Claim 34 wherein:

the first rotator is a valve lash adjusting screw-driver which further comprises a first electric motor, a rotatable inner spindle and a valve lash adjusting screw bit; and

the second rotator is a valve lash lock nut-driver which further comprises a second electric motor, a gear, a rotatable outer spindle and a nut-receiving socket concentric with the bit;

in at least one operating condition, the probe and the plunger are automatically movable toward an engine cylinder head concurrently with and within 45^{o} of the same advancing direction as the valve lash adjusting screw-driver and the valve lash lock nut-driver.

36. The apparatus of Claim 29 wherein the verifier comprises a plunger which is automatically advanced, and an angle of rotation of the first rotator is measured, after a sudden point of change in displacement versus angle data is determined in order to verify the valve lash setting.

37. The apparatus of Claim 29 further comprising:

a rocker arm;

the verifier comprising a plunger;

the tool having at least one spring; and

the first rotator being rotated an angular amount to set valve lash;

thereafter, the valve lash being subsequently verified by retracting the previously advanced plunger and biasing the rocker arm toward the valve lash adjusting screw by the at least one spring, and measuring displacement of the rocker arm with the verifier.

38. A valve lash adjustment system comprising:

an engine valve assembly including a valve stem, a biasing member and a retainer operably coupling the biasing member to the valve stem;

a rocker arm contactable against the valve assembly;

an adjuster moveable to cause different valve lash settings, the adjuster being coupled to the rocker arm;

a driver operably moveable to engage the adjuster and automatically move the adjuster to a desired valve lash setting position;

a first measurer operably moveable in an automatic manner to directly contact against the valve assembly;

a second measurer operably moveable in an automatic manner to directly contact against a portion of the rocker arm adjacent the valve assembly; and

a controller automatically determining the valve lash based on at least the differences in displacement of the first and second measurers.

39. The system of claim 38 wherein:

the controller is connected to the measurers and the driver;

the driver is part of a factory-mounted machine and includes an automatically powered actuator; and

the valve assembly, rocker arm and adjuster are part of an internal combustion engine, and multiple engines each have their valve lash set by the machine; and

the system does not need to set and determine the actual zero initialization position of a valve lash adjustment screw.

40. The system of claim 38 wherein each of the measurers include a linearly moveable probe, an automatic actuator and a sensor.

41. The system of claim 38 wherein the measurers are extendable in substantially parallel directions free of rotating components.

42. The system of claims 38 further comprising a locking nut rotator automatically controlled by the controller, and the driver being operable to rotate the adjuster which is an externally threaded, valve lash adjusting screw.

43. The system of claim 38 wherein the controller automatically verifies if a desired valve lash setting is obtained.

44. A method of setting valve lash for an internal combustion engine, the method comprising:

(a) sensing values associated with valve lash adjusting screw rotation as a function of at least one of: (i) valve lash adjusting screw torque, (ii) valve displacement, and (iii) rocker arm displacement;

(b) inputting a precursor value based on at least one of: (i) a change point of at least a predetermined variation in the sensed values, and (ii) a predetermined threshold value;

(c) using the precursor value as the initialized starting point for subsequent movement setting when adjusting valve lash adjusting screw rotation; and

(d) automatically adjusting the valve lash at least in part by adjusting valve lash adjusting screw rotation.

45. The method of Claim 44 further comprising automatically verifying the actual valve lash adjustment and determining if the actual adjusted valve lash measurement is acceptable.

46. The method of Claim 45 wherein the valve lash is automatically adjusted a second time if the verified actual valve lash value is not acceptable.

47. The method of Claim 46 further comprising transmitting an error indication if the verified actual valve lash value is not acceptable after automatic readjustment a predetermined number of times.

48. The method of Claim 44 further comprising:

(a) automatically rotating a socket to rotate a valve lash lock nut;

(b) automatically rotating a bit, located concentrically within the socket, to rotate a threaded valve lash adjusting screw;

(c) extending a probe to contact a rocker arm spaced from a center of rotation so as to sense a displacement proportional to rocker arm motion in alignment with the valve stem axis;

(d) sensing a value indicative of the interface valve lash gap between the probe and the rocker arm;

(e) automatically advancing a plunger, located so as to rotate the rocker arm substantially eliminating the valve lash gap and verifying the actually adjusted valve lash; and

(f) moving the socket, the bit, the probe and the plunger toward the rocker arm within 45° of the same direction.

49. The method of Claim 44 wherein the valve lash adjusting screw torque is used as one of the sensed values.

50. The method of Claim 44 wherein the valve displacement is used as one of the sensed values.

51. The method of Claim 44 wherein rocker arm displacement is used as one of the sensed values.

52. A method of using a machine to set valve lash by adjusting at least first and second members associated with an engine valve having a biasing device, the method comprising:

(a) automatically rotating the first member;

(b) automatically rotating the second member;

(c) automatically compressing the biasing device in a temporary manner;

(d) automatically determining if the actual adjustments to the first and second members provided a desired result with the engine valve; and

(e) automatically readjusting the first and second members if it is determined in step (d) that the actual adjustments did not provide the desired result.

53. The method of Claim 52 further comprising transmitting an error signal if multiple verification determinations are made and the valve adjustments, which are valve lash adjustments, continue to be unacceptable.

54. The method of Claim 52 further comprising the automated and sequential steps of at least:

(a) backing off the first member, which is a nut, from the second member, which is a threaded valve lash adjusting screw, while deterring the valve lash adjusting screw from moving;

(b) setting the valve lash adjusting screw to a valve actuating mechanism preloaded position;

(c) setting the valve lash by further rotating the valve lash adjusting screw;

(d) deterring rotation of the valve lash adjusting screw while the nut is tightened; and

(e) performing the valve gap determination step to verify the setting.

55. The method of Claim 52 further comprising setting the valve lash without any one of: (a) setting an initial true zero lash position for a valve lash adjusting screw or the valve; and (b) determining an initial true zero lash position for a valve lash adjusting screw or the valve prior to valve lash adjusting screw movement by the machine.

56. A method of setting valve lash for an internal combustion engine, the method comprising:

(a) sensing values associated with valve lash adjusting screw rotation as a function of at least one of: (i) valve lash adjusting screw torque, (ii) valve displacement, and (iii) rocker arm displacement;

(b) inputting a precursor value based on at least one of: (i) a change point of at least a predetermined variation in the sensed values, and (ii) a predetermined threshold value;

(c) using the precursor value as the initialized starting point for subsequent movement setting when adjusting valve lash adjusting screw rotation; and

(d) determining if a faulty valve seating condition exists.

57. The method of Claim 56 further comprising automatically verifying the actual valve lash adjustment and determining if the actual adjusted valve lash value is acceptable.

58. The method of Claim 57 wherein the valve lash is automatically adjusted a second time if the verified actual valve lash value is not acceptable.

59. The method of Claim 56 further comprising:

(a) automatically rotating a socket to rotate a valve lash lock nut;

(b) automatically rotating a bit, located concentrically within the socket, to rotate a threaded valve lash adjusting screw;

(c) extending a probe to contact a rocker arm spaced from a center of rotation so as to sense a displacement proportional to rocker arm motion in alignment with the valve stem axis;

(d) sensing a value indicative of the interface valve lash gap between the probe and the rocker arm;

(e) automatically advancing a plunger, located so as to rotate the rocker arm substantially eliminating the valve lash gap and verifying the actually adjusted valve lash; and

(f) moving the socket, the bit, the probe and the plunger toward the rocker arm within 45° of the same direction.

60. The method of Claim 56 wherein the faulty valve seating condition is caused by an improperly bent valve stem.

61. The method of Claim 56 further comprising sending an output signal indicative of the faulty valve seating condition different than an output signal indicative of other conditions.